Upper Monument Creek Ecological Restoration Project

HydrologyReport

Prepared by:
Leah Lessard
Hydrologist

for:
Pikes Peak Ranger District
Pike National Forest

July 12, 2016

Introduction

The purpose of the Upper Monument Creek Ecological Restoration Project (hereinafter "UMC project" or "UMC project area") is to improve forest health and ecosystem services and to increase the resiliency of the forest to catastrophic, high intensity wildfire, insect epidemics and disease through adaptive management processes.

This report focuses on watershed resources including soil and water and discusses ecosystem components including wetland and riparian areas. It discusses existing conditions by Watershed, Soil and Water; proposed management actions pertaining to these resources; and the expected effects of proposed actions within the UMC project area.

Overview of Issues Addressed

The following factors influence soil, water, and watershed resources within the UMC project: forest structure and density; vegetative cover; invasive terrestrial and aquatic species; acres of bare ground and disturbed soil;disturbed or impaired stream reaches; acres of proposed treatment; average gradient in proposed treatment; acres of proposed treatment in wetland and riparian areas;existing soil stability and productivity;and surface/storm water conveyance.

The proposed management actions addressvegetation management, floodplain improvement, prescribed burning of natural fuelsand wildlife habitat improvement. Vegetation management coversapproximately 28,000 acres in a variety of forest types and would encourage the development of large trees, create heterogeneous structural characteristics, develop understory plant diversity, increase forage productivity, create small and larger forest openings, and increase resilience to disturbances such as wildfire. Floodplain improvement areas will be implemented on approximately 3,700 acres.Floodplain improvement treatment includes thinning of encroaching trees to restore meadow features, hydrologic function, and aquatic habitat conditions. Floodplain and watershed restoration may also include willow staking/transplanting, aspen and native species planting, seeding, soil stabilization, improvements to storm water conveyance and improvements to impaired stream channels.Prescribed burning of natural fuels, where ecologically appropriate, on up to 2,285 acres, would reduce fuel loads, increase understory productivity and diversity, allow fire to perform its natural ecological role, and reduce uncharacteristic disturbance from wildfire, insects, and disease.Wildlife habitat improvement objectives will be employed throughout the landscape using various vegetation management techniques.The proposed action identifiesareas for treatment that reduce the potential for catastrophic wildfire, improve the resiliency of the ecosystem to disturbance, enhance wetland, riparian and stream health, protect municipal water supplies,and enhance wildlife habitat. Additionally, proposed management actions would maintain and enhance culturally significant resources, settings, viewsheds, and sensitive plant and animal species habitat.

Existing watershed condition classes, state and federal regulations, forest plan guidance, water quality standards, research reports, Collaborative Forest Landscape Restoration Project/The Nature Conservancy (CFLRP/TNC) partnership reports, Geographic Information System

(GIS)analysis, public scoping outcomes, partnership needs, and field reconnaissance serve as the basis for this report.

Affected Environment

Existing Condition

This section describes the existing conditions within the Upper Monument Creek project area, by watersheds, soil, and water.

Existing Condition - Watersheds

The US Forest Service completed an assessment of all 6th Level watersheds on National Forests in 2010. Several watersheds within the project area were re-assessed and ratings updated after the 2012 Waldo Canyon wildfire. Ratings utilized the 2010 Forest Service Watershed Condition Classification Technical Guide, which is available at: http://fsweb.wo.fs.fed.us/wfw/watershed/classification/watershed_classification_guide-oct-25-2010.pdf

Watershed condition classification is the process of describing watershed condition in terms of discrete classes that reflect the level of watershed health or integrity. The Forest Service Manual uses three classes to describe watershed condition:

- Class 1 – **Functioning Properly** - watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 2 – **Functioning at Risk** - watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 3 – **Impaired Function** - watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.

The 2010 and post-Waldo Canyon Fireassessments document the overall function of each watershed, with the condition of each watershed rated as Properly Functioning, Functioning at Risk, orImpaired Function. The watersheds are also given ratings for 12 condition indicatorsby an interdisciplinary team of forest resource specialists (Table 1).The existing conditions classes for each of the analyzed UMC project area watersheds are listed in Table 2. Indicators and attributes for each watershed can be viewed in the Appendix.TheUMC Ecological Restoration Project list of proposed actions are expected to reduce the overall risks to water quality,aquatic habitat, riparian/wetland vegetation, roads/trails, and soils in response to high severityfire. Collectively these actions expect to promote improvement so overall forest and watershed health.

Table 1. Watershed condition indicators

AQUATIC PHYSICAL INDICATORS	
1. Water Quality	This indicator addresses the expressed alteration of physical, chemical, and biological components of water quality.
2. Water Quantity	This indicator addresses changes to the natural flow regime with respect to the magnitude, duration, or timing of the natural stream flow hydrograph.
3. Aquatic Habitat	This indicator addresses aquatic habitat condition with respect to habitat fragmentation, large woody debris, and channel shape and function.
AQUATIC BIOLOGICAL INDICATORS	
4. Aquatic Biota	This indicator addresses the distribution, structure, and density of native and introduced aquatic fauna.
5. Riparian/Wetland Vegetation	This indicator addresses the function and condition of riparian vegetation along streams, water bodies, and wetlands.
TERRESTRIAL PHYSICAL INDICATORS	
6. Roads and Trails	This indicator addresses changes to the hydrologic and sediment regimes due to the density, location, distribution, and maintenance of the road and trail network.
7. Soils	This indicator addresses alteration to the natural soil condition, including productivity, erosion, and chemical contamination.
TERRESTRIAL BIOLOGICAL INDICATORS	
8. Fire Regime or Wildfire	This indicator addresses the potential for altered hydrologic and sediment regimes due to departures from historical ranges of variability in vegetation, fuel composition, fire frequency, fire severity, and fire pattern.
9. Forest Cover	This indicator addresses the potential for altered hydrologic and sediment regimes due to the loss of forest cover on forestland.
10. Rangeland Vegetation	This indicator addresses impacts to soil and water relative to the vegetative health of rangelands.
11. Terrestrial Invasive Species	This indicator addresses potential impacts to soil, vegetation, and water resources due to terrestrial invasive species (including vertebrates, invertebrates, and plants).
12. Forest Health	This indicator addresses forest mortality impacts to hydrologic and soil function due to major invasive and native forest pest insect and disease outbreaks and air pollution.

Table 2lists all watersheds in and around the project area. Four watersheds would beminimally impactedby the proposed action, with less than 1% of the watersheds falling within the project analysisboundary. Therefore, these watershedsare not included for further analysis.Two additionalwatershedsare excluded from the affected environment because the Waldo Canyon Fire burned through most of these watersheds thus eliminating the need for vegetation treatment as part of this analysis. The excluded watersheds are Bear Creek, Headwaters Fountain Creek, Headwaters Trout Creek, Carpenter Creek, Lower Monument Creek, and Garden of the Gods. Table 2 identifies the watersheds included in the project analysis area. The West Monument Creek and Upper Monument Creek watersheds are particularly critical, as they are sources of

municipal drinking water for Colorado Springs and Palmer Lake respectively. Colorado Springs Utilities also has a pipeline supply network from the West Monument Creek watershed to feed the Rampart Reservoir in the southwest corner of the project area. This reservoir provides up to 80 percent of Colorado Springs drinking water at any given time. The Waldo Canyon Fire burned a significant portion of the West Monument Creek watershed contributing to the impaired hydrological function of this landscape.

Table 2.Upper Monument Creek Project Area watershed condition class– Included Watersheds

6th Level - Watershed	HUC 12	Acres	% Within Project Area	Watershed Condition Class	Status
Beaver Creek	110200030101	17060.3	84	1.4	Functioning Properly
Horse Creek-Trout Creek	101900020105	32001.0	21	2.5	Impaired Function
Middle Monument Creek	110200030105	36143.3	11	1.4	Functioning Properly
Upper East Plum Creek	101900020502	18942.4	12	1.5	Functioning Properly
Upper Monument Creek	110200030102	27573.6	60	1.6	Functioning Properly
West Monument Creek	110200030103	15064.7	85	2.4	Impaired Function
Headwaters West Plum Creek	101900020602	22113.0	8	1.5	Functioning Properly
Long Gulch-Trout Creek	101900020103	28086.0	15	2.3	Impaired Function

Key

Condition Class

Class **1** - **1.6** = Functioning Properly

Class **1.7** - **2.2** = Functioning at Risk

Class **2.2** - **3** = Impaired Function

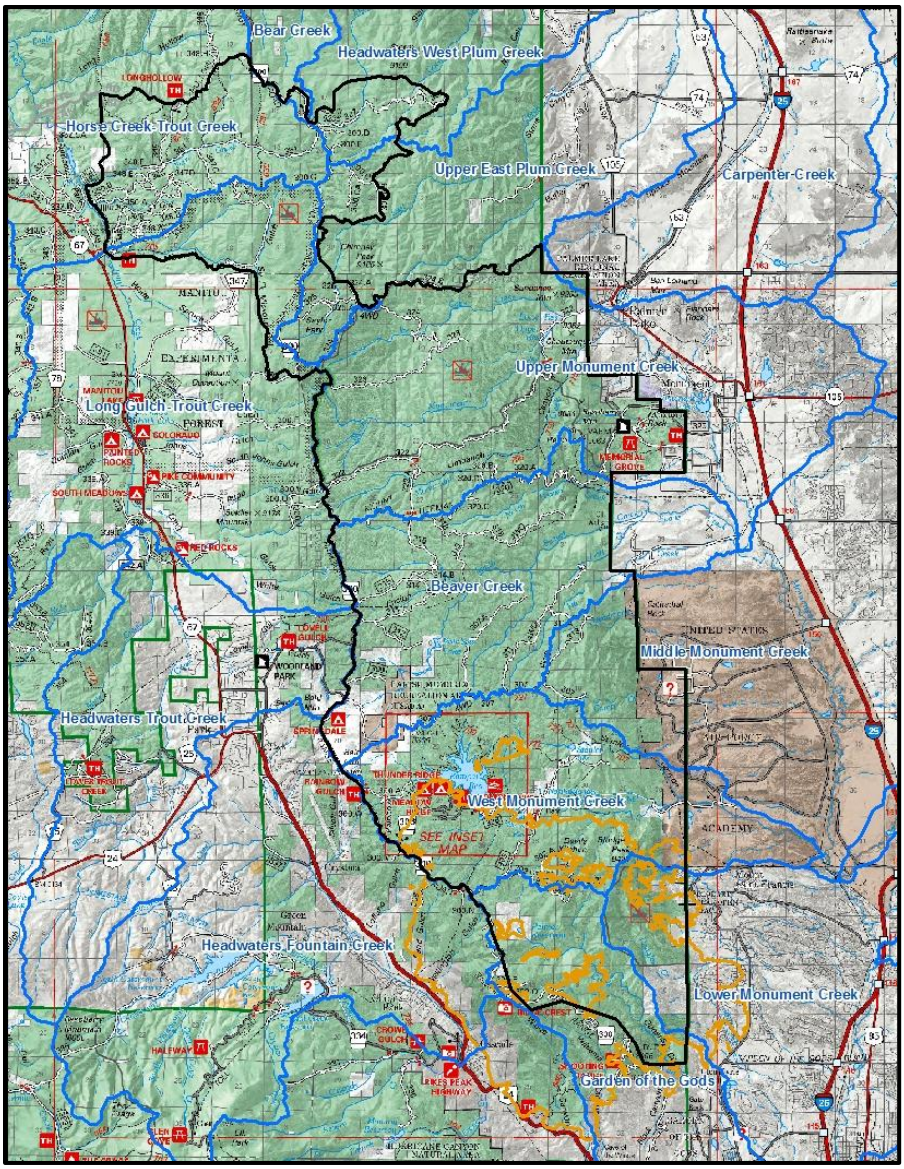
Table 3. Upper Monument Creek Project Area - Excluded Watersheds

6th Level - Watershed	HUC 12	Acres	% Within Project Area
Bear Creek	101900020601	10326.5	1
Headwaters Fountain Creek	110200030201	27940.9	<1
Headwaters Trout Creek	101900020102	18710.2	<1
Carpenter Creek	101900020501	17655.8	<1
Lower Monument Creek	110200030107	32073.9	8
Garden of the Gods	110200030204	19902.4	24

Existing Conditions by 6th Level Watershed

Watershed existing condition is detailed below and is further summarized in the Appendix.

Figure 1. Locator map with watersheds within the project area.



Beaver Creek Watershed Existing Conditions

The Beaver Creek sixth level watershed is 17,060 acres. Beaver Creek is a perennial stream that runs through this watershed. It has a number of small tributaries including North Beaver Creek, South Beaver Creek and Hell Creek joining to form Beaver Creek as it flows east from the Rampart Range divide down towards I-25 and the confluence with Monument Creek. The Beaver Creek watershed is in the Arkansas River Basin. 83.9% of the watershed (14,308acres) is within the project analysis area.There are 38.73 miles of road in the watershed. Elevations

range from about 6,900 near Monument to 9,270 feet at the top of the watershed near Rampart Range Road. The proposed treatment polygons are in the upper and central parts of the watershed.

The Beaver Creek watershed condition class was rated as Category 1.4 – Functioning Properly (Forest Service, 2010). Aquatic Biota is classified as having impaired function.

(a) Horse Creek-Trout Creek Watershed Existing Conditions

The Horse Creek – Trout Creek sixth level watershed is 32,001 acres. Within this watershed, Trout Creek is a perennial stream with a number of small tributaries joining the river as it flows from Woodland Park towards Deckers along State Highway 67 north.The Horse Creek-Trout Creek watershed is in the South Platte River Basin. As Trout Creek flows north, the name changes to Horse Creek at the confluence with West Creek. 21% of the watershed (6,707acres) is within the project analysis area.There are27.22miles of road in the watershed. Elevations range from about 7,700 feet near Rainbow Falls to 6,800 feet at the confluence with West Creek. The proposed treatment polygons are in the southeast portion of the watershed near Rampart Range Road and Rainbow Falls recreation area.

The Horse Creek – Trout Creek watershed condition class was rated as Category 2.5 – Impaired Function. Water Quality, Aquatic Habitat, Aquatic Biota, Riparian Vegetation, Soil, Rangeland and Terrestrial Invasive Species are all classified as having impaired function.

(b) Middle Monument Creek Watershed Existing Conditions

Middle Monument Creek sixth level watershed is 36,143 acres. Within this watershed Monument Creek is a perennial stream located east of USFS managed lands. Goat Camp Creek and Deadmans Creek are tributaries to Monument Creek in the Middle Monument Creek watershed. The Middle Monument Creek watershed is in the Arkansas River Basin 10.9% of the watershed (3948.8acres) is within the project analysis area.There are 3.62 miles of road in the watershed. Elevations range from about 7,100 feet at the US Air Force Academy to 9,200 feet at the headwaters. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The Middle Monument Creek watershed condition classwas rated as Category 1.4 – Functioning Properly. Aquatic Biota and Fire Effects & Regime are classified as impaired function.

(c) Upper East Plum Creek Watershed Existing Conditions

Upper East Plum Creek sixth level watershed is 18,942 acres. Within this watershed,East Plum Creek is a perennial stream that runs through Stone Canyon and joins up with Cook Creek southwestof Larkspur. The Upper East Plum Creek watershed is in the South Platte River Basin and the river flows north into Chatfield Reservoir. 12.4% of the watershed (2,344acres) is within the project analysis area.There are 13.53 miles of road in the watershed. Elevations range from about 6,659 at Larkspur to 9,200 feet near Saylor Park. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The Upper East Plum Creek watershed condition classwas rated as Category 1.5 – Functioning Properly. Aquatic Biota is classified as impaired function.

(d) Upper Monument Creek Watershed Existing Conditions

Upper Monument Creek sixth level watershed is 27,573 acres. Within the watershed, Monument Creek is a perennial, municipal water supply stream that runs through the watershed with a number of tributaries, including North Monument and Ice Cave Creek, joining the river as it flows east from Rampart Range down to Palmer Lake and Monument. The municipal water supply reservoir is west of the Town of Palmer Lake. The main-stem of Monument Creek continues south from Monument to Colorado Springs along Interstate Highway 25. The Upper Monument Creek watershed is in the Arkansas RiverBasin. 60.7% of the watershed (16,734acres)is within the project analysis area.There are 34.42miles of road in the watershed. Elevations range from about 6,975 near Monument to 9,400 feet at Rampart Range Road. On US Forest Service managed lands the proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.Adjacent to this area are proposed treatments on US Air Force property, in the central portion of the watershed.

The Upper Monument Creek watershed condition classwas rated as Category 1.6 – Functioning Properly. Aquatic Biota, Fire Effects & Regime and Terrestrial Invasive Species are all classified as impaired function.

(e) West Monument Creek Watershed Existing Conditions

West Monument Creek sixth level watershed is 15,064 acres. Within this watershed,West Monument Creek is a perennial, municipal water supply stream that runs through the watershed. There are a number of small ephemeral tributaries originating in Northfield Gulch, Devil's Kitchen and Blodgett Peak joining the stream as it flows from Monument to Colorado Springs along Interstate Highway 25. The Beaver Creek watershed is in the Arkansas River Basin. 85.5% of the watershed (12,874acres)is within the project analysis area.There are 27.66miles of road in the watershed. Elevations range from about 6,900 at the US Air Force Academy to 9,400 feet at the Rampart Range dividing road. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The West Monument Creek watershed condition classwas rated as Category 2.4 – Impaired Function, reflecting the impact of the 2012 Waldo Canyon Fire.(Forest Service, 2010 updated). Aquatic Biota, Fire Effects & Regime and Terrestrial Invasive Species are all classified as impaired function.

Headwaters West Plum Creek Existing Conditions

Headwaters West Plum Creek sixth level watershed is 22,113 acres. Within the watershed, Stark and Gove Creeks are perennial flowing streams. The Headwaters West Plum Creek watershed is in the South Platte River Basin and flows north to the confluence with East Plum Creek and into Chatfield Reservoir municipal water supply. 8.1% of the watershed (1799.8acres) is within the

project analysis area.Most of the USForest Service managed lands in this watershed are in the roadless management area.

The Headwaters West Plum Creek watershed condition classwas rated as Category1.5 – Impaired Function.Aquatic Biota, Fire Effects & Regime and Terrestrial Invasive Species are all classified as impaired function.

(f) Long Gulch-Trout Creek Watershed Existing Conditions

Long Gulch - Trout Creek sixth level watershed is 28,806 acres. Within the watershed, Trout Creek is a perennial stream that runs through the watershed with a number of small tributaries joining the river as it flows from Woodland Park towards Deckers along State Highway 67 north including Long Gulch, Ryan Gulch, Quinlan Gulch, Johns Gulch and Hotel Gulch. 15.2% of the watershed (4,255acres)is within the project analysis area.There are 11.83 miles of road in the watershed. Elevations range from about 7,700 feet near Rainbow Falls to 8,400 feet at the headwaters of Ryan Gulch. The proposed treatment polygons are in the upper portion of the watershed near Rampart Range Road.

The Long Gulch - Trout Creek watershed condition classwas rated as Category 2.3 – Impaired Function. Water Quality, Aquatic Habitat, Aquatic Biota and Riparian Vegetation are all classified as impaired function.

The Town of Palmer Lake Watershed is approximately 10,425 acres and located mainly within the project boundary on National Forest managed lands. Proposed actions will comply with relevant laws, regulations, and policies including the cooperative agreement for the purpose of conserving and protecting the water supply of Palmer Lake, the City of Monument, the City of Colorado Springs and all relevant water supplies.

Existing Condition – Soil and Water

Existing Condition – Soil

Research reports, consultant reports, field reconnaissance, Natural Resource Conservation Service (NRCS) soil surveys, and GIS analysis were utilized to determine existing soil resources and condition in the Upper Monument Creek project analysis area. Soils within the Upper Monument Creek Project Area are derived mostly from decomposed granite parent material. The parent rock is deeply weathered Pikes Peak Granite composed of large crystals. These large crystals then form a mass of coarse-grained material with little clay to serve as binding material oras exchange medium for soil nutrients. These soil particles are highly erodible and may be relatively unproductive due to a lack of soil nutrients.

The analysis area is largely characterized by rocky, shallow, coarse textured decomposing Pikes Peak granite with thin organic layers. These soils are particularly vulnerable to rill and gully erosion, if protective ground cover is removed. Exposed surface area (bare ground) and a lack of

vegetation leads to accelerated drainage flows with increased stream power. Erosion potential is higher on steep slopes and adjacent to less permeable surfaces such as rock outcrops or roads, trails, and travelways.

Fifteen percent of the analysis area lies on <10% slope,twenty-seven percentlies on 10-20 % slopes,twenty-four percent lies on 20-30% slopes, fifteen percent lies on 30-40%, and twenty percent lies on >40% slopes.

Table 4. Slopes within the UMC Project Area

Slope %	0 – 10%	10 – 20%	20 – 30%	30 – 40%	>40%
Project Area %	15%	26%	24%	15%	20%

Generally rocky, coarse textured soils are not susceptible to deep compaction except on heavily used travelways. Studies have found that these decomposed, granitic soils maintain high infiltration rates even when used for skid trails (Libohova 2004).However, existing National Forest System and user-created travel ways are heavily compacted due to high use and have low rates of infiltration causing increased surface-water runoff. Soil erosion can occur when surface-water flows over areas with reduced ground cover and where compaction has decreased soil infiltration rates.

Other existing impacts to soil within the UMC project area affecting (or potentially affecting) watershed health include:environmental influences, dispersed shooting areas, dispersed camping, Waldo Canyonburn scar, grazing allotments, mining activities, activities on private inholdings,existing National Forest System travel ways, and Non-system off-road vehicle.

In general scheduled road maintenance occurs every one to seven years depending on the condition of the road, the assigned maintenance level, and the maintenance priority. Other scheduled maintenance occurs as specific needs are identified. Portions of the existing road system will be used in this project and may require upgrading roads based on safety and resource concerns. Resource concerns were identified during the Travel Analysis Process (TAP) and specific impairments are known to District operations personnel, staff, hydrologists, engineers, and other resource specialists. All roads in the project area were given risk ratings during the TAP (Table 5). Arating of 3 (High) was assigned to roads with significant length within thewatershed, length within 300’ of a watershed, length within highly erodible soils or high number of streamcrossings. A rating of 2 (Moderate) was assigned to roads where the numbers were lower for: lengthwithin watershed, length within 300’ of a stream, length within highly erodible soils, and number ofstream crossings. A rating of 0 (Low) was assigned to roads where there were few to no stream crossings, and having low percentage in erodible soils and watersheds. As part of the adaptive management strategy, all high risk roads within a watershed will be reviewed during layout to address site specific concerns including: poor drainage; stream crossings, downcutting or aggrading road ditches; undersized culverts; and storm flows that further degrading the road prism.

Table 5. Travel Analysis Process Watershed Risk Ratings

Road Number (NFSR)	Watershed Risk	Road Number (NFSR)	Watershed Risk	Road Number (NFSR)	Watershed Risk	Road Number (NFSR)	Watershed Risk
300	1	320	3	348	1	918	1
300.B	0	320	0	348	1	919	0
300.G	0	320.A	0	348.A	0	920	0
300.H	0	320.B	0	348.B	1	921	1
300.I	0	320.C	0	348.C	1	924	0
300.J	0	320.D	0	348.D	0	925	0
300.K	0	322	1	348.E	0	926	0
300.L	0	322	0	348.F	3	927	0
304	1	322	0	348.G	0	928	1
307	0	322	1	350.A	1	929	0
307.A	0	322.A	3	350.B	0	930	0
309	0	323	1	351	3	933	0
311	0	324	1	905	0	934	0
311.A	1	324.A	1	906	0	935	0
312	0	324.B	1	907	1	936	0
312.A	0	325	1	908	0	937	0
313	1	325.A	0	909	0	939	0
314	3	325.B	3	911	0	944	0
314.A	3	344	1	912	3	947	1
314.B	3	344.B	0	913	0		
315	1	347	1	915	0		
318	1	347.C	3	916	0		
319	3	347.E	3	917	1		

Linear features like roads can convert subsurface runoff to surface runoff and then route the surface runoff to stream channels, increasing peak flows. Therefore, watersheds with higher road densities have a higher sensitivity to increases in peak flows following wildfires. Road density in miles of road per square mile of watershed area was used as an indicator of watershed risk in the TAP. Table 6 displays the road density ratings within the analysis area for the Upper Monument Creek watersheds.

Table 6. Road Densities by Watershed

Watershed Name	Road Density (mi./sq. mi)
Beaver Creek	1.73
Headwaters West Plum Creek	2.46
Horse Creek-Trout Creek	2.60
Long Gulch-Trout Creek	1.78
Middle Monument Creek	0.59
Upper East Plum Creek	3.69
Upper Monument Creek	1.32
West Monument Creek	1.37

Soil productivity and soil erosion are considered in the Watershed Condition Class framework to havefunctioning at risk and impaired function condition classes within the project area (see Appendix). Soil nutrient and hydrologic processes are considered to have functioning at risk or impaired functionconditions for the majority of the project area.Soil condition indicators for each watershed within the project area are summarized in the Appendix.

Erosion hazard ratings were used as a comparative analysis to determine locations vulnerable to erosion. Ratings are based upon slope, soil series (or geology, soil depth, and soil texture) and a climatic stress factor which is a function of mean annual precipitation. An erosion hazard rating is the potential erosion hazard multiplied by the climatic stress factor. Approximately 67.2% of the project is categorized to have a higher erosion hazard rating, 24.8% is categorized to have a moderate rating, and 6.6% has a low rating. The erosion hazard rating is not analyzed for 1.3% of the project area.

Figure 2. Soil Erosion Hazard Rating Summary Map

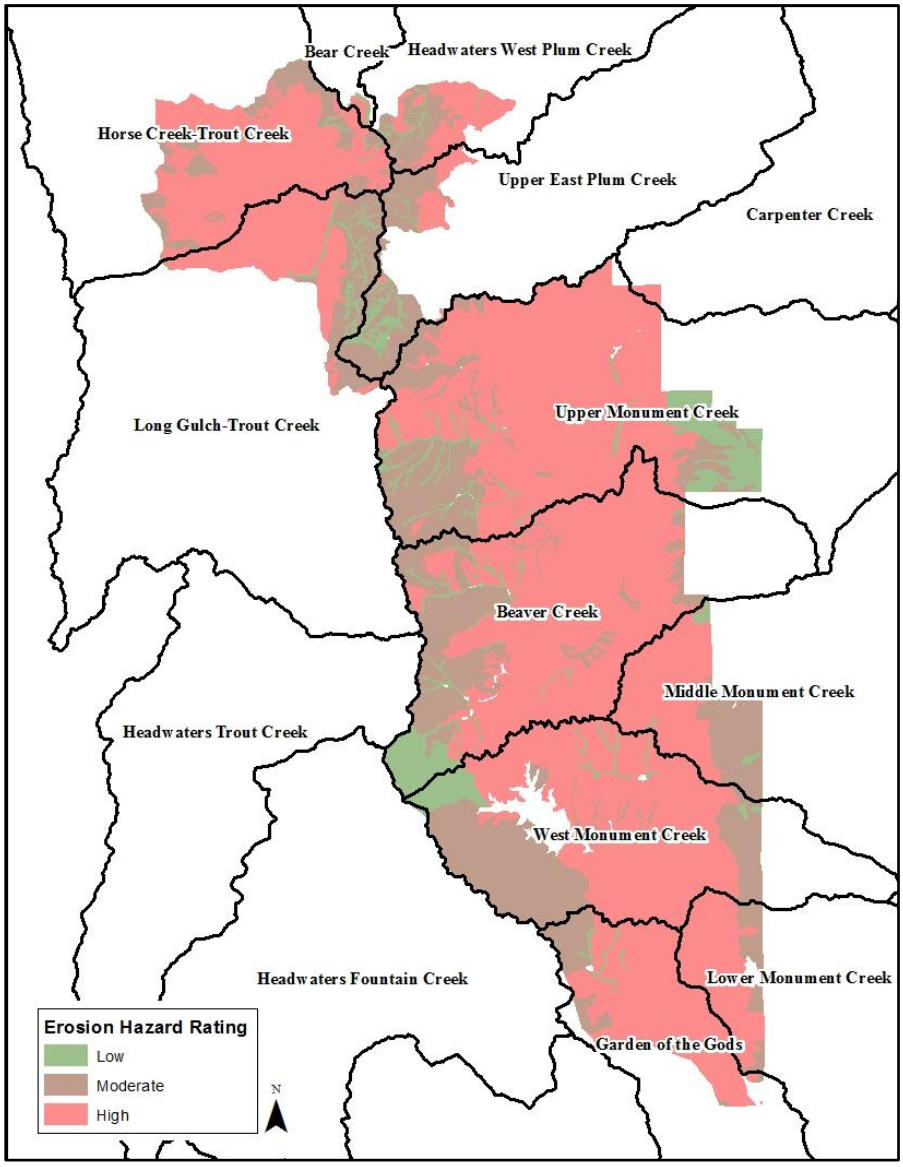


Table 7. Soil Erosion Hazard Ratings - Percent of Watershed

Watershed Name	% of each Watershed			
	*Not classified	Rating 1 – Low	Rating 2 – Moderate	Rating 3 - High
Beaver Creek	0.28%	7.8%	22.16%	69.76%
Headwaters West Plum Creek	0%	6.44%	37.52%	56.04%
Horse Creek-Trout Creek	0%	0.99%	18.53%	80.48%
Long Gulch-Trout Creek	0%	7.90%	30.43%	61.66%
Middle Monument Creek	0.08%	2.67%	31.67%	65.58%
Upper East Plum Creek	0.03%	15.44%	64.19%	20.34%
Upper Monument Creek	0.10%	10.37%	20.05%	69.48%
West Monument Creek	5.56%	5.17%	29.52%	59.75%

* Not classified because landscape islocated on private lands or water

Existing Condition – Water

There are perennial, intermittent, and ephemeral stream channels throughout the project area.Perennial streams flow continuously. Perennial streams are generally associated with a water table in the localities through which they flow. Intermittent or seasonal streams flow only at certain times of the year when they receive water from springs or surface source such as melting snow in mountainous areas. Ephemeral streams flow only in direct response to precipitation, andchannels are at all times above the water table (Meinzer, 1923).

Monument Creek and Trout Creek are the largest streams in the project area. Using the Rosgen stream channel classification system they are considered C type streams (Rosgen 1994), which are lower gradient, sinuous, fish bearing and have greater stream base flow compared to other streams in the watershed. The other streams in the project area are generally steep gradient, tightly confined ephemeral or intermittent first or second order, Rosgen type A or B streams.

Some ephemeral and intermittent channels in the project area have impaired function due to storm water flow off from adjacent roads and trails. These channels are hydrologically connected to motor vehicle use on system and non-system routes(authorized and unauthorized). Many of the channels have eroded into entrenched gullies with active channel headcutting and lateral bank movement resulting in increased erosion and downstream sediment deposition.

Ephemeral streams are important for hydrological function of watersheds and provide opportunities of unique habitats. Streams downcutting into deep gullies have lost their floodplain connectivity and functionality. Without access to the surrounding floodplain, high energy storm flows cause increased down cutting within the confined channel, lateral migration and increased erosion and sediment delivery to downstream perennial streams and water supplies. Additionally downcutting also results in loss of water storage capacity in subsurface soils. This loss in subsurface water storage results in a corresponding loss in riparian vegetationfurther degrading

both the quality of wildlife habitats and the ability of riparian corridors to deal with high surface flows in the future.

Table 8. Miles of stream (by flow) within each watershed

6th Level - Watershed	Miles of Perennial within Analysis Area	Miles of Intermittent within Analysis Area	Miles of Ephemeral within Analysis Area
Beaver Creek	20.81	74.42	105.46
Horse Creek-Trout Creek	5.08	38.86	52.24
Long Gulch-Trout Creek	6.65	19.26	24.82
Middle Monument Creek	0.00	15.32	13.11
Upper East Plum Creek	1.82	15.20	20.42
Upper Monument Creek	22.06	98.84	130.53
West Monument Creek	4.42	69.01	76.54
Headwaters West Plum Creek	0.86	12.01	18.32

The most recent Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List is effective 03/01/2016. Lists are updated regularly therefore, actions within the project area or near the project area can affect the current status of listed or unlisted waters. At this time there are no 2016 303d listings within the project area.BMPs will be used to avoid any potential impacts to water quality including those unlisted in Colorado's Section 303(d).

Additional Considerations

Local landowners, land managers and stakeholders are collaborating with the Forest Service to achieve common goals and desired conditions concerning the UMC project. A few of these land management areas include: theWaldo Canyon Burn Area, Manitou Experimental Forest,United States Air Force, Colorado Springs Utilities, City of Monument (City of Monument Storm Water Protection Plan) and the Town of Palmer Lake (Municipal Watershed). The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission has assigned beneficial or protected uses of the surface waters in the UMC Project Area through Regulation No.31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31). Beneficial uses may include: recreation, water supply, agriculture, industrial uses, and the protection and propagation of fish and wildlife. These beneficial uses are expected to be protected by monitoring water quality standards, applying appropriate design criteria and use of BMPs. Waters are classified by the uses for which they are presently suitable or intended to become suitable.

Desired Condition

(i) Compliance with Relevant Laws, Regulations, Policies and Plans

The Proposed Action would be consistent with all Forest Plan Goals, and General direction, standards and guidelinesexcept for the Goals pertaining to increasing water yield.

The Forest Plan, as amended, provides programmatic management direction for National Forest Service (NFS) lands on the Pike San Isabel Cimmaron and Comanche(PSICC). Through its goals, standards and guidelines, and Management Area (MA) direction, the Forest Plan provides the overall guidance for management of NFS land within the PSICC's borders.

The Forest Plan divides the PSICC into individual MAs and designates specific direction, goals, standards, and guidelines to be used in the management of each area to meet its emphasis more completely. Applicable direction for the eight MAs in the analysis area is described below.

Table 9. Forest Plan Management Areas within the project area.

Semi-primitive Motorized Recreation (MA 2A): This MA covers 10,944 acres (16 percent) of NFS lands in the analysis area. MA 2A emphasizes semi-primitive motorized recreation opportunities, such as snowmobiling, four-wheel driving, and motorcycling, both on and off roads and trails. Motorized travel may be restricted or seasonally prohibited to protect physical and biological resources. General direction for dispersed recreation management is to prohibit motorized vehicle use off roads and trails where needed to protect soils, vegetation, or special wildlife habitat (page III-109). Standards and guidelines for MA 2A are found in the Forest Plan on pages III-107 to III-115.
Rural and Roaded-Natural Recreation (MA 2B): This MA covers 21,253 acres (32 percent) of NFS lands in the analysis area. MA 2B emphasizes rural and roaded-natural recreation opportunities. Motorized and non-motorized recreation activities such as driving for pleasure, viewing scenery, picnicking, fishing, snowmobiling and cross-country skiing are possible. Motorized travel may be restricted or seasonally prohibited to protect physical and biological resources. General direction for visual resources is to manage activities to maintain or improve the quality of recreation opportunities. Management activities are not evident, remain visually subordinate, or may dominate, but harmonize and blend with the natural setting. Standards and guidelines for MA 2B are found in the Forest Plan on pages III-116 to III-124.
Wildlife Habitat Management for Management Indicator Species (MA 4B): This MA covers 7,116 acres (11 percent) of NFS lands in the analysis area. MA 4B emphasizes providing wildlife habitat needs and permits dispersed non-motorized and motorized recreation.Standards and guidelines for MA 4B are found in the Forest Plan on pages III-134 to III-143.
Big Game Winter Range (MA 5B): This MA covers 4,029 acres (6 percent) of NFS lands in the analysis area. MA 5B emphasizes the management of big game winter and summer range.Standards and guidelines for MA 5B are found in the Forest Plan on pages III-149 to III-160.
Wood-Fiber Production and Utilization (sawlogs) (MA 7A): This MA covers 3,934 acres (6 percent) of NFS lands in the analysis area. MA 7A emphasizesproductive tree stand management on lands available, capable and suitable for production of a variety of commercial and noncommercial wood products.Standards and guidelines for MA 7A are found in the

Forest Plan on pages III-169 to III-178.
Wood-Fiber Production and Utilization for products Other Than Sawtimber (MA 7D): This MA covers 6,279 acres (9 percent) of NFS lands in the analysis area. MA 7D emphasizes productive tree stand management on lands available, capable and suitable for production of a variety of products other than sawtimber.Standards and guidelines for MA 7D are found in the Forest Plan on pages III-179 to III-188.
Experimental Forest (MA 10B): This MA covers 4,407 acres (7 percent) of NFS lands in the analysis area. MA 10B emphasizes providing for the management of existing or potential research areas.Standards and guidelines for MA 10B are found in the Forest Plan on pages III-227 to III-228.
Municipal Watershed (MA 10E): This MA covers 8,880 acres (13 percent) of NFS lands in the analysis area. MA 10E emphasizes protecting or improving the quality and quantity of municipal water supplies. Management practices vary from use restrictions to water resource improvement practices, with the primary objective of meeting water quality standards established for the individual watershed. A secondary objective is to manage the watersheds to improve the yield and timing of water flows, consistent with water quality requirements. General direction for dispersed recreation management is to allow motorized travel only on established roads and trails. Close the watershed to all travel when the road or trail surfaces could be damaged to the degree that water quality could be degraded (III-234). Standards and guidelines for MA 10E are found in the Forest Plan on pages III-233 to III-241.

The desired condition for the UMC project is to improveforest health and ecosystem services by creating a more diverse forest structure resilient to anticipated future environmental conditions, including catastrophic, high intensity wildfire, insect epidemics and disease. The desired conditions for watershed health and soil and waterresources are based on Forest Plan guidance, state, federal, and local standards, literature reviews, and Watershed Condition Framework definitions of properly functioning watersheds.

Desired Condition – Watersheds

Thedesired condition is to improve the watersheds that are not properly functioning. Watershed condition classes and their attributesare expected to improve by the proposed action.As the proposed action is implemented the watershed condition indicators will be updated to reflect improvements. Attributes that are expected to improve by the proposed action are highlighted in redand described in Table 10.

Table 10. Watershed Condition Classification Attributes Affected by the Proposed Action

Core Indicator	Attributes	Improvements as a result of the Proposed Action
Water Quality	Impaired Waters	Improve water quality by decreasing sediment loads into streams
	Water Quality Problems	
Water Quantity	Flow Characteristics	

Aquatic Habitat	Habitat Fragmentation	Functionality of ephemeral drainages and gullies will be restored and resiliency to floods improved
	Large Woody Debris	
	Channel Shape and Function	
Aquatic Biota	Life Form Presence	
	Native Species	
	Exotic and/or Invasive Species	
Riparian Vegetation	Vegetation Condition	Improve functionality by removing upland species from riparian corridors
Road & Trail Network	Open Road Density	Improve road maintenance where there is unacceptable impairments
	Road Maintenance	
	Proximity to Water	
	Mass Wasting	
Soil	Soil Productivity	Restoring forest health will restore soil nutrient and hydrologic cycling processes. Closing user-created shooting areas, user-created campsites, OHV hillclimbs, and other bare ground/disturbed areas will reduce soil erosion
	Soil Erosion	
	Soil Contamination	
Fire Effects & Regime	Fire Condition Class	Restore the watershed to vegetation characteristics that mimic natural historic range of variability
	Wildfire Effects	
Forest Cover	Loss of Forest Cover	
Rangeland	Vegetation Condition	
Terrestrial Invasive Species	Extent & Rate of Spread	The expansion of noxious weed populations will be reduced by improving the resiliency of the natural ecosystem
Forest Health	Insects & Disease	The threat to insects and disease will be reduced by restoring watershed to the natural historic range of variability
	Ozone	

Watershed condition reflects a range of variability from naturally pristine (functioning properly) to degraded (severely altered state or impaired). Watersheds that are functioning properly have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within their range of natural variability for these processes (USDA Forest Service 2011).

To the extent possible, the desired condition is to improve all watersheds to properly functioning Watershed Condition Class I watersheds. It is the desired condition that streams meet all Federal Clean Water Act standards and Colorado Department of Public Health and Environment beneficial uses(CDPHE, Regulation 31- Basic Standards and Methodologies for Surface Water).

Desired Condition – Soils

The desired condition is to have hillslopes and soils in a satisfactory natural functioning condition that resists erosion. Bare ground would be reduced thus reducing soil hazard risk ratings. The desired condition would increase soil productivity providing water infiltration, maintenance of soil nutrients, and reduced sediment yields and erosion.

The desired condition is a transportation system that does not contribute elevated sediment yields into streams degrading water quality. The desired condition is to limit erosion from unauthorized and poorly maintained roads and trails. Roads and trails that are contributing sediment at elevated levels will be repaired and mitigated. The transportation system will have road densities that meet Forest Plan Standards and Guidelines

Desired Condition – Water

The desired conditionis to restore or maintain the functionality of ephemeral, intermittent, and perennial streams and springs. A healthy stream system is a hydrologically functioning stream system. Hydrologic function is measured by having a stable stream dimension, pattern and profile that causes either degradation or aggradation of the stream channel. When addressing the causes of stream degradation, vegetation management alone is insufficient to restore stream function. Poor road drainage and undersized culverts that cause eroding gullies should also be corrected to reduce sedimentation and improve stream health. Where necessary, streams will be restored to have: floodplain access; reduced down cutting; limited bank erosion resulting in less sedimentation; reduced stream temperatures; and, increased groundwater storage/recharge to the system.

Riparian areas provide critical ecosystem services. Riparian vegetation including grasses, forbs, and woody plants growing along the edges of ephemeral and perennial drainages is critical for controlling erosion, improving water quality, and providing habitat. Willows are among the most common woody plants found in riparian areas. They are an important source of food and cover for wildlife and their roots help stabilize streambanks minimizing wind and water erosion. Aspen trees also create sustainable interfaces between wetland/riparian and upland ecotones.An aspen component will lower overall crown fire potential of wetland and riparianareas, as aspen is inherently less flammable and capable of carrying crown fire when compared to conifers. Regenerating aspen clones in specific locations where clones are decadent or where additional age classes are needed to help perpetuate healthy aspen clones will benefit wetland and riparian areas. Aspen clones provide shade to wetland and riparian corridors, strengthen stream banks with root development, serve as sediment and debris filters from upland sites, and provide woody debris that adds to stream channel structure and function.

The Pike National Forest has been monitoring the effects of catastrophic wildfire and the effects of post-wildfire recovery (NFF Conservation Campaign Treasured Landscapes, Unforgettable Experiences #VE-203, 2010-2013 and Waldo Canyon Fire 2014 BAER Effectiveness Monitoring, Rocky Mountain Field Institute, 2015). The changes in runoff, sediment transport and erosion is documented for both the Hayman and Waldo Canyon Fires in watershed analysis studies (Waldo Canyon Fire Watershed Assessment: The WARSSS Results. 2013 and Trail Creek Watershed Assessment & Conceptual Restoration Plan: The WARSSS Results, 2011.) The Hayman Fire (2002) and the Waldo Canyon Fire (2012) have both demonstrated the long term detrimental effects of large catastrophic wildfires. Substantial amounts of riparian vegetation was lost, which has significantly impacted erosion rates and watershed health. Vegetation treatment within the UMC project area will reduce the risk and cost of emergency

response and restoration as well as reduce the potential length of time until reforestation, and hydrologic and watershed recovery. The desired condition of the UMC project area is to reduce the risks of loss from wildfire effects byimproving watershed health with vegetation treatment.

Environmental Consequences

Methodology

This section describes the effects of Alternative 1 (No Action) and Alternative 2 (Proposed Action), onthe watersheds, soil, and water of the UMC Project Area.Proposed actions in this report address adaptive management treatments types for floodplain improvements and watershed health. Floodplain improvement treatmentsare describe using three major categories: Riparian and Wetland Vegetation Enhancement, Hillslope and Stream Restoration, and Soil Stability. Affects to watersheds, soil, and water are described within each treatment category.

(g) Alternative 1 – No Action

(i) Direct and Indirect Effects

The UMC landscape contains nine 6th level watersheds (see Figure 14) and with the exception of the West Monument Creek watershed, which has been the most heavily altered by the Waldo Burn footprint, the remaining 8 watersheds will remain at risk from large-scale high intensity fire events. Within the Upper Monument Creek watershed, no treatments will occur around and upstream from critical municipal drinking water sources for the communities of Monument and Palmer Lake. The no action alternative would not provide any opportunities to change the way and scale at which fire events move across the landscape under extreme weather conditions.

Alternative 1 (No Action) would have no positive direct or indirecteffects on watersheds, soil, or water of the Upper Monument Project Area. No vegetation or adaptive management treatments would be implemented under this alternative. Many of the non-system travel ways and unimproved National Forest System travel ways would remain on the landscape for extended periods and persist as a source of sediment contributing to degraded soil and water conditions.Indirect effects include continued adverse impacts to watershed health, soil, and water; and an increase in forest density over time that would have an increased risk of catastrophic wildfire compared to the existing conditions. The lack of project implementation will increase the probability of catastrophic fire, thus increasing risks to watershed health and soil and water resources.

(ii) Cumulative Effects

This section presents the potential cumulative effects of the past, present and future foreseeable actions in the watersheds of the Upper Monument Creek Project Area. Under Alternative 1, there would be no vegetation treatments on National Forest System (NFS) lands in the Upper Monument Creek Project Area. While the recent and on-going vegetation treatments on private

lands, near Palmer Lake and Monument within the UMC Project Area would help to reduce stand densities and create a more diverse landscape, NFS lands cover twice the area compared to private lands. Without any treatments on these lands, a large portion of the UMC Project Area would be characterized by relatively dense stands of ponderosa pine and mixed conifer.

The cumulative effect of the past, present and reasonably foreseeable future actions on the condition of the forest vegetation in the UMC Project Area under Alternative 1, would be an area dominated by forest stands that are generally healthy but relatively homogenous in age and structure and increasingly at risk to insects, disease, and catastrophic wildfire. Watershed health and soil and water resources are adversely affected by catastrophic wildfire. The no action alternative is expected to result incumulative impacts to watershed health and soil and water resources produced by future high intensity wildfires.

The cumulative effect of the past, present and reasonably foreseeable future actions in the UMC Project Area under the No Action Alternative, would be an area with persistent adverse effects precipitated by non-system travel ways and unimproved National Forest System travel ways. Under the No Action Alternative, degradation in the UMC Project Area is expected to continue causing increased resource damage and impaired watershed health.

(h) Alternative 2 – Proposed Action

In an effort to protect and improve watershed health, the US Forest Service proposes adaptive management including vegetation treatments to alter forest stand and understory conditions within the 70,600 acre Upper Monument Creek Project Area. If, over time, the proposed action is not helping to protect and improve watershed health, project specialists and decision makers will make changes to implementation through adaptive management.

Floodplain Improvement

Floodplain improvement treatments would occur on approximately 3,940 acres of the analysis area. They would be applied to improve the Watershed Condition Classificationand attain overall project desired conditions. Floodplain improvements include riparian and wetland vegetation enhancement, hillslope and stream restoration, and soil stability. These management activities may include:

- Thinning of encroaching upland vegetation to restore meadow features, hydrologic function, and aquatic habitat conditions.
- Enhancing aspen component of the landscape by expanding access to available growing space or through regeneration.
- Broadcast burning and the removal of woody coniferous and decadent (i.e. decaying, non-vigorous) vegetation encroachment resulting from past fire exclusion to protect and restore watershed function.

- Willow staking and transplanting will improve channel function and enhance riparian buffers.
- Riparian/wetland vegetation planting will restore features to a properly function condition.
- Reducing hydrologic connectivity with abundant sediment sources and minimizing soil erosion and sedimentation will result in effective sediment transport and maximize riparian vegetation.
- Restoring disturbed areas include hillslope/rill/gully erosional surfaces contributing sediment to streams will maintain water quality and re-establish vegetation cover.

Riparian and Wetland Vegetation Enhancement

Floodplain improvements found in between draws and in valley bottoms bounded by upland forests has highly variable vegetation and can range from nearly pure even-aged aspen stands to conditions and structures that closely mimic uneven-aged mesic mixed conifer forests. Trees in these areas are typically larger than the surrounding upland site due to the alluvial soils and mesic conditions that classify these areas. These areas have better growing conditions that can support greater tree densities than more upland sites and typically have two to three distinct canopy classes.

The mesic conditions that typify these areas do not tend to favor frequent low intensity fire. More typically these areas are prone to high intensity and severity fires that occur infrequently. These fires tend to originate in upland sites and can carry into wetlands and riparian areas during optimum burning conditions and/or during extended drought periods when riparian areas are much drier than normal. The good growing conditions, capacity of maintaining high levels of tree density and typically infrequent fire return intervals means that conifer encroachment and fuel loadings in these areas can be relatively high under normal conditions.

Wetland and riparian areas, and corresponding vegetation, are important components of the larger watershed health as they serve as filters for upland sedimentation, buffer overland flow of water, sustain ecological diversity, and provide hydrological input into larger stream classes.

Management goals within the wetland and riparian ecological system are to reduce fuels, increase structural diversity, break canopy continuity where uniform canopy cover exists, perpetuate vigorous aspen clones, and protect and enhance the large conifer component of these systems. Where possible, prescribed fire should be used to reduce fuel loads, increase structural heterogeneity, and enhance understory herbaceous vegetation.

Direct and Indirect Effects

The proposed activities may indirectly benefit water quality by reducing the potential for and extent of high severity wildfires. High intensity wildfires and emergency fire management have the potential to degrade water quality through the removal or modification of vegetative cover in areas known to have highly erosive soils. High intensity fires in these areas is expected to increase runoff and erosion, accelerate nutrient inputs, and allow for the transport of large volumes of sediments to downstream.

Mechanical or hand thinning would be implemented to achieve desired objectives and conditions in wetland and riparian corridors.Removing upland and encroaching species from wetland riparian corridors willimprove watershed functionality.Critical riparian areas will also be identified for willow staking/transplanting activities.Willow species collected from local sites will be replanted to help expand or reestablish these cover types as dictated by local site conditions. Woody riparian cover types help tobuffer flood flows and provide a living response to flood events.Such improvements will result in less erosion, less sediment transport, less habitat damage, and improvements in water quality. Site-specific objectives and treatments will be finalized during project layout. Design criteriawill be applied to ensure that sensitive riparian areas important for diversity and wildlife habitat are preserved.

The direct and indirect effects of Alternative 2 (Proposed Action) could, but are not likely to, result in potential increases in peak flows. Recent research findings suggest that in snow zones, thinning less than 40 percent of a watershed would result in only a 14 percent increase in the size of peak flows (Elliot et al. 2010). Increases in peak flows by themselves do not constitute an adverse impact unless they adversely impact the beneficial uses of a stream which would trigger a violation of the current Forest Plan. None of the watersheds analyzed will receive thinning levels greater than 40%. Consequently, the proposed vegetation management activities are expected to have little effect on the overall increase in peak flows.

The proposed action alternatives would have no adverse impact on floodplains or wetlands as described in Executive Orders 11988 and 11990. Floodplains and wetlands will be protected by applicable of WIZ buffers, application of design criteria, and use of BMPs. Springs, seeps and other wetlands will be excluded from mechanized activities and will be protected by site-specific implementation of BMPs.

Hillslope and Stream Restoration

Ephemeral and intermittent stream channels by their nature do not have perennial stream flows and so do not generally have well-established riparian vegetation to help hold and armor stream banks. Care to avoid removing vegetation assisting in holding streambanks together is important for ephemeral drainage floodplain function. Impaired soils and erosion may be stabilized utilizing slash, reseeding, and adding drainage features to reduce concentration of flows. Providing groundcover, establishing native vegetation and reconnecting the floodplain will improve hydrologic function and restore watershed health. Where downcutting is evident and incised channels are restricting floodplain access for storm flows, vertical incised banks may be laid back creating a bankful bench, filling in the channel/gully with native materials, and other erosion control features maybe necessary to meet desired stabilization objectives. Desired stabilization objectives, including: reducing bare ground; improving stream function; and restoring floodplain connectivity will provide favorable conditions for downstream wetland and riparian vegetation cover types. Site-specific activities will be identified during layout phases in order to ensure appropriate design and restoration objectives are met.

Direct and Indirect Effects

The overall goal of this restoration is to restore and stabilize site conditions while providing favorable conditions for downstream wetland and riparian vegetation cover types. Concentrated flow across a hillslope increases energy thereby increasing the potential of active soil erosion. These areas may be hydrologically connected to critical systems such as perennial streams, wetlands, riparian zones, or upland hillslopes. Hillslope derived sediments reaching the stream system can stay staged in the channel for years, causing direct effects to riparian areas and downstream impacts on water quality. The proposed action recommends stabilizing hillslopes and streams that are hydrologically connected to critical systems or that have the potential to impact critical systems. These areas have evidence of erosion and loss of soil productivity. There may be ruts, rills, less vegetation or plant biomass than in adjacent areas. Mitigation for surface erosion provides an increase in ground cover/surface protection, and breaks-up continuous slope length across the bar hillslope, reducing the erosive energy. The proposed mitigation on bare soils will reduce erosion and sediment delivery into critical systems and water supplies. Stabilization of these areas would mitigate hillslope erosion, improve control of soil loss and sediment yield in riparian areas, and have positive impact on downstream water quality.

Soil Stability

Slope and soils are the factors that drive the design criteria for bare ground and openings created for landings, and temporary roads. The proposed action treatment units are limited by the erosive nature of the soils within the project area. Treatment units, temporary roads and landings will be located on lower gradient slopes to reduce risk of sediment transport. Mechanically treatable units were identified on slopes less than30 percent and mechanically marginal treatments (or hand treatments with chainsaws and tracked masticators) were identified on slopes 30-40 percent.There are currently no areas with average slopes greater than 40 percent that are scheduled for treatment with the UMC project area.

In order to improve watershed health many of the roads in the project area require culvert and storm water drainage improvements.Roads built on erodible soils and with an improperly planned road drainage network can impair the water quality in nearby streams (USDA Forest Service 2001). The effects of road drainage can include an increase in the peak discharge, changes in the shape and timing of the hydrograph, increases in the total discharge, and a decrease in water quality (USDA Forest Service 2001). Roads that are in close proximity to streams and road-stream crossings may cause changes to a stream's hydraulic regime, reduction in water quality, and sedimentation (USDA Forest Service 2001).

Under-sized culverts or bridges can wash out, contributing to erosion and sedimentation at levels detrimental to other aquatic resources (USDA Forest Service 2001). Culvert outlets also concentrate storm water and often gullies are created leading to sediment deposition in riparian areas, sediment aggradation causing a loss of channel capacity, and sediment delivery to

perennial streams. Many roads have damage where maintenance berms have limited outflows and caused concentrated flow to damage the fill-slope.

There exists user created roads and trails across the landscape. These roads have not been properly designed to be sustainable to the surrounding environment or included on our Motor Vehicle Use Map (MVUM) system as a safe travel route. These roads will be completely rehabilitated, reducing risk of future sediment transport to streams. These routes will be evaluated and improved.Abandoned roads that have revegetated naturally and are stable would likely not be disturbed.

The transportation system within the floodplain would be managed through road maintenance, use of temporary roads, and seasonal or permanent closures as needed to support public access, proposed forest management activities, wildlife habitat quality, and aquatic habitat connectivity. The majority of road-related activities would make use of the existing system road network. During project implementation, temporary roads would be constructed, and are to be closed and restored upon completion of treatments.

(i) Direct and Indirect Effects

Vegetation treatment activities, including felling, skidding, decking, transporting of logs off-site, masticating, and slash disposal, can affect soil resources. Potential effects to soil resources include soil compaction and displacement. Soil erosion can occur when rainstorms occur on sites where the ground cover has been removed and the infiltration rate of soils is reduced due to compaction. Ground disturbing activities associated with the proposed action may directly impact soil productivity by displacement, compaction, loss of organic matter, rutting, erosion and loss of soil porosity. Design criteria have been included for vegetation treatments to minimize soil disturbance in Alternative 2 (Proposed Action). Vegetation treatments in alternative 2 are also focused on reducing or avoiding the negative impacts of high intensity fires on soils by modifying forest structure. No new system roads would be constructed, although use of temporary roads will be necessary to allow for logging and other forest management activities.

Given the adaptive nature of this project, site-specific implementation of BMPs, design criteria, and avoiding disturbances of sensitive soil types and steep slopes will be included as part of project layout and design. Consequently, all project activities considered would be expected to be in full compliance with the Forest Plan. The direct and indirect effects of Alternative 2 (Proposed Action) on soil productivity would be a potential slight decrease in soil productivity in the short term (less than five years) and a potential increase in soil productivity in the long term (greater than five years). Long-term increases in soil productivity could be achieved from the increases in ground cover due to the opening of the forest canopy in treated areas.

Other soil stabilizing activities including the management and improvements to road and trail systems allow for the use of techniques to improve stream crossings, storm water conveyance, culvert function, and other indirect effects associated with roads and trails in the project area.

Gullies formed by concentrated flow derived from culvert outlets or large storm events may be stabilized with native rocks, trees and other vegetation. As dictated by site-specific conditions, erosion control features may be included perpendicular to storm flows across the hillslope to help reduce the potential for soil erosion. Non-system and relic routes and trails resulting in impaired soils, bare ground, or concentrated water flows would be stabilized.

Temporary roads will have design criteria added to ensure erosion and soil disturbance is mitigated. Engineers and hydrologist will assist during layout. If designed properly, these routes are relatively stable and will be completely restored after use. Other existing unsustainable user created routes in the project area will be included for restoration as part of the proposed action. Closing of these features would include re-contouring soils to align with the natural hillslope, creating an environment better able to support native vegetation, laying down slash, erosion control features, and adding drainage features to reconnect floodplains.

The combination of proposed road improvements and reduction in the number of legacy roads and trails are intended to minimize road-related erosion as a whole. Other improvements, such as culvert replacements, ditch clean outs, and surface re-contouring are also expected to have positive effects on reducing sediment yield. Improving the structure, stability and drainage of haul roads is expected to mitigate most of the erosion potential.

Cumulative Effects

Watershed cumulative effects from sediment are an important concern in managed watersheds (Megahan and Hornbeck 2000). Sediments that reach the stream system can stay in the channel for years and create instream sediment sources that may have impacts at the site and downstream. Riparian vegetation provides a wide variety of benefits to stream systems, including providing shade to control stream temperature, root strength to maintain stream banks, and input of nutrients that form the base of many aquatic food webs (Bisson et al. 1987). Riparian areas can also serve as filters for increased sediment generated upslope. Stream buffers have been shown to be very effective in moderating cumulative watershed effects (Thomas et al. 1993 and Elliot et al. 2010).

The watersheds within the UMC project area have been identified in need of protection and restoration given concerns for meeting water quality standards and other resource objectives. Increasing land-uses, increased risk to high intensity wildfire, along with other environmental influences have resulted in cumulative impacts and alteration of watershed conditions within the project area.

Since the Hayman Fire, much has been learned about the Pikes Peak Granite and the longevity of the erosion processes following high intensity wildfire events. Based on going monitoring by Robichaud and others from the US Forest Service Rocky Mountain Research Station (RMRS), there was still evidence of soil erosion and riling after large storm events in undisturbed areas.

Incorporating appropriate drainage and other maintenance to existing transportation routes, coupled with use of best management practices in the design of roads and trails in the project area will help to generate positive cumulative effects on watershed and stream conditions by reducing levels of erosion and sediment loads. No additional road density will be added as a result of this decision, while several user created trails and roads will be rehabilitated.

The Waldo Canyon Fire occurred within the UMC project area in 2012, resulting in severe soil erosion, sedimentation, and deposition. Adverse impacts resulting from the wildfire affected streams, reservoirs, and water supply infrastructure. Mitigation work focused on curbing these adverse impacts is an on-going effort that will likely continue until natural recovery is fully established. The acres burned are within the project boundary, but are not included within treatment units of the project. The continuing restoration activities within the burn are expected to have long-term positive cumulative effects within and downstream from the Upper Monument Creek project area.

Buffers, transportation system management and other mitigations will reduce sedimentation into drainages. Rehabilitation of landings, skid trails and temporary roads can be effective. The efforts made to close off and rehabilitate illegal hill climbs and other illegal off highway vehicle (OHV) activity, and to improve system roads in the project area helps to improve the cumulative effects on watershed health. The cumulative effects should be a positive gain in both the short term and long term.

Project design criteria and associated BMPs for road obliteration and decommissioning would reduce the risk of sediment entering stream courses. The impacts to water quality caused by sedimentation due to temporary road construction, reconstruction, maintenance, or road decommissioning, if any, would be short-term and undetectable at the watershed scale. Any short-term increases in sediment is expected to be negligible in comparison to the elevated sediment transport following a catastrophic wildfire.

Best management practices, monitoring and adaptive management will be implemented to minimize the probability of degrading waters within the planning area or downstream. Any effects would be short-lived and only detectable at the site scale. Best Management Practice monitoring will help determine if sediment delivery is occurring necessitating a change in project implementation strategies.

At a landscape scale, significant surface erosion may result in the event of a large scale naturally occurring disturbances like high intensity wildfires and large storm events. When fully implemented the treatments proposed in Alternative 2 will help to mitigate some of this risk by restoring or altering stand structure and species composition in ways the help reduce the intensity and scale of future landscape level disturbances that would subsequently increase surface erosion and mass wasting potential.

Design Features and Mitigation Measures

Design criteria to limit disturbance includes compliance with Forest Plan guidance, National and State Best Management Practices, Watershed Conservation Practices criteria, and all other relevant laws, regulations, and policies.

Forest management activities in any wetland, riparian area, and flood plain, will be designed to prevent long and short-term adverse impacts, in accordance with Executive Orders 11988 and 11990, the direction outlined in Forest Service Manual, sections 2526, 2527, and 2633, and in Management Prescription 9A.(Forest Plan)

Watershed Conservation Practices Handbook (FSH 2509.25) provides standards for activities on the Pike National Forest. Colorado State Best Management Practices (BMP's), National Best Management Practices for Water Quality Management on National Forest System Lands, and "Watershed Conservation Practices" (WCP's) are intended to control non-point source pollutants.

The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission has assigned beneficial or protected uses of the surface waters in the UMC Project Area through Regulation No.31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31). Beneficial uses may include recreation, water supply, agriculture, industrial uses, and the protection and propagation of fish and wildlife. These beneficial uses are protected by water quality standards. Waters are classified by the uses for which they are presently suitable or intended to become suitable.

"For all state waters existing classified uses and the level of water quality necessary to protect such uses shall be maintained and protected. No further water quality degradation is allowable which would interfere with or become injurious to these uses. The classified uses shall be deemed protected if the narrative and numerical standards are not exceeded."

The Clean Water Act requires all states submit a list of impaired and threatened waters (stream/river segments, lakes) for US Environmental Protection Agency (EPA) approval every two years. CDPHE Water Quality Control Commission publishes the Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List (Regulation 93: 5 C.C.R. 1002-93). The regulation identifies all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards, and establish priorities for development of Total Maximum Daily Loads (TMDLs), monitoring, and evaluation. This is based on the severity of the pollution and the sensitivity of water uses, among other factors. Impairments affect water quality and the US Forest Service must ensure proposed actions and mitigations are consistent with CDPHE anti-degradation rules to limit further water quality degradation.

The Forest Plan requires that: "All activities occurring on the Forest must be mitigated if necessary in order to meet state water quality standards as well as threshold sediment levels." (USDA Forest Service PSICC Forest Plan)

The most recent Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List is effective 03/01/2016. Lists are updated regularly therefore, actions within the project area or near the project area can affect the current status of listed or unlisted waters. At this time, there are no 2016 303d listings within the project area. BMPs will be used to avoid any potential impacts to water quality including those unlisted in Colorado's Section 303(d).

Work in the project area should be completed with the overall project objectives and watershed health in mind. Work should be completed in a manner that best limits the disturbance on the landscape. Forest management activities in any wetland, riparian area, and floodplain, will be designed to limit and prevent short and long-term adverse impacts. BMPs will be implemented to minimize the probability of degrading waters within and downstream of the project area. Monitoring will be used to determine if there are adverse effects occurring necessitating a change to project implementation strategies (Forest Service, 2012).

Adaptive management strategies will be used in conjunction with monitoring to achieve desired improvements in watershed condition and health. Watershed health can be measured in the Watershed Condition Classification using indicators described in the Watershed Condition Framework. As the project is implemented, watershed and core indicator conditions will be monitored. Monitoring and reporting will be used as a tool to provide flexibility to account for inaccuracies in initial assumptions, to adapt to changes in environmental conditions, and/or to respond to monitoring information indicating that desired objectives are not being met. If monitoring indicates that management actions are not achieving desired conditions, then changes to the implementation strategy will be taken. All implementation action will be modified using one or more of identified design criteria or BMPs in order to achieve the intended effects.

(i) Monitoring Recommendations

BMP monitoring would occur during and after management activities. BMP implementation monitoring would occur during management activities and through contract administration and partnership agreements. Monitoring would focus on vegetation management activities and on detrimentally impacted soils (if they exist).

Adaptive management will be used to incorporate monitoring to achieve desired conditions in watershed health. Watershed health can be measured in the Watershed Condition Classification using indicators described in the Watershed Condition Framework. As the project is implemented, watershed and core indicator conditions will be monitored. Monitoring and reporting will be a tool that will provide flexibility to account for inaccurate initial assumptions, to adapt to changes in environmental conditions or to respond to monitoring information that indicates that desired conditions are not being met. If monitoring indicates that management actions are not achieving desired conditions, then changes to the implementation strategy will be addressed. The implementation action will be modified using one or more of the identified adaptive management actions in a way that better achieves the intended effects.

References

Bisson, P.A.; Bilby, R.E.; Bryant, M.D.; [and others]. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. Streamside Management: Forestry and Fisheries Interactions. Institute of Forest Resources Contribution No. 57. E.O. Salo and T.W. Cundy. Seattle, University of Washington: 143-190.

Colorado Department of Public Health and Environment. 2013. Regulation No.31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31).

Colorado State Forest Service. (2010). Forestry Best Management Practices to Protect Water Quality in Colorado.

Elliot, William J.; Miller, Ina Sue; Audin, Lisa. Eds. 2010. Cumulative watershed effects of fuel management in the western United States. Gen. Tech. Rep. RMRS.GTR.231. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 299 p.

Grigal, D.F. 2000. Effect of Extensive Forest Management on Soil Productivity. Forest Ecology and Management, 138, 167-185.

Libohova, Z. 2004. Effects of Thinning and a Wildfire on Sediment Production Rates, Channel Morphology, and Water Quality in the Upper South Platte River Watershed. Master of Science Thesis, Department of Forest, Rangeland, and Watershed Stewardship, Colorado State University, Fort Collins, Colorado, Spring 2004.

MacDonald, L.H. and J.D. Stednick. 2003. Forests and Water: A State-of-the-Art Review for Colorado. CWRRI Completion Report No. 196.

Megahan, W.F. and J. Hornbeck. 2000. Lessons learned in watershed management: a retrospective view. USDA Forest Service Proceedings RMRS-P-13.

Meinzer, O.E. 1923. Outline of Ground-Water Hydrology. Geological Survey Water-Supply Paper 494. U.S. Geological Survey, Washington, DC.

Miller, D. E., and J. B. Ritter 1996. An examination of the Rosgen classification of natural rivers, Catena, 27, 295–299.

Natural Resources Conservation Services. 1992. Soil Survey of Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties.
Potyondy, J.P. and Geier, T.W. 2010. Watershed Condition Classification Technical Guide. USDA Forest Service. *Note: PSICC Updated Database 2010.*

Rice, R. M. and Sherbin, S. A. 1977. Estimating sedimentation from an erosion-hazard rating. USDA Forest Service Research Note PSW-323.

Rocky Mountain Field Institute. 2014. Upper South Platte/Hayman Conservation Campaign Final Effectiveness Monitoring Report.

Rocky Mountain Field Institute and USDA Forest Service. 2015. Waldo Canyon Fire 2014 BAER Effectiveness Monitoring.

Rosgen, D. L. 1994. A Classification of Natural Rivers, Catena, 22, 169–199.

Rosgen, D. L. 2011. Wildland Hydrology. Trail Creek Watershed Assessment & Conceptual Restoration Plan: The WARSSS Results of the Hayman Fire.

Thomas, J.W., M.G. Raphael, R.G. Anthony. E.D. Forsman, A.G. Gunderson, R.S. Holthausen, B.G. Marcot, G.H. Reeves, J.R. Sedell and D.M. Solis. 1993. Viability assessments and management considerations for species associates with late successional and old growth forests of the Pacific Northwest. Pacific Salmon Workgroup.

Town of Monument Source Water Protection Plan. townofmonument.org.

USDA Forest Service. 2001. Forest Roads: A Synthesis of Scientific Information.

USDA Forest Service. 2006. FSH 2509.25 Watershed Conservation Handbook.

USDA Forest Service. 2012. National Best Management Practices for Water Quality Management on National Forest System Lands.

USDA Forest Service. 2015. Travel Analysis Process Report Addendum, Pikes Peak Ranger District.

USDA Forest Service. 2015. Bear Creek Watershed Improvement Environmental Assessment Hydrology Specialist Report.

USDA Forest Service. Rocky Mountain Region. Land and Resource Management Plan Pike and San Isabel National Forests Comanche and Cimarron National Grasslands.

Wildland Hydrology and USDA Forest Service. 2013. Waldo Canyon Fire Watershed Assessment: The WARSSS Results.

APPENDIX – Watershed Condition Class Framework

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
110200030101	Beaver Creek	1.4	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.4	Road & Trail Network	1.5	Open Road Density	2
							Road Maintenance	1
							Proximity to Water	2
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.2	Fire Effects & Regime	1	Fire Condition Class	1
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	1
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020105	Horse Creek-Trout Creek	2.5	Aquatic Physical	2.6	Water Quality	3	Impaired Waters	3
							Water Quality Problems	3
					Water Quantity	2	Flow Characteristics	2
					Aquatic Habitat	2.7	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	3
			Aquatic Biological	3	Aquatic Biota	3	Life Form Presence	3
							Native Species	3
							Exotic and/or Invasive Species	3
					Riparian Vegetation	3	Vegetation Condition	3
			Terrestrial Physical	2.1	Road & Trail Network	1.8	Open Road Density	1
							Road Maintenance	2
							Proximity to Water	3
							Mass Wasting	1
					Soil	2.3	Soil Productivity	3
							Soil Erosion	3
							Soil Contamination	1
			Terrestrial Biological	2.2	Fire Effects & Regime	1	Fire Condition Class	1
							Wildfire Effects	N/A
					Forest Cover	2	Loss of Forest Cover	2
					Rangeland	3	Vegetation Condition	3
					Terrestrial Invasive Species	3	Extent & Rate of Spread	3
					Forest Health	2	Insects & Disease	1
							Ozone	3

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
110200030105	Middle Monument Creek	1.4	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.2	Road & Trail Network	1	Open Road Density	1
							Road Maintenance	1
							Proximity to Water	1
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.8	Fire Effects & Regime	3	Fire Condition Class	3
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	2	Vegetation Condition	2
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020502	Upper East Plum Creek	1.5	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.3	Road & Trail Network	1.3	Open Road Density	1
							Road Maintenance	1
							Proximity to Water	2
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.8	Fire Effects & Regime	2	Fire Condition Class	2
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	2	Vegetation Condition	2
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	2	Insects & Disease	1
							Ozone	3

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
110200030102	Upper Monument Creek	1.6	Aquatic Physical	1.3	Water Quality	1	Impaired Waters	1
							Water Quality Problems	1
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.6	Road & Trail Network	1.8	Open Road Density	2
							Road Maintenance	2
							Proximity to Water	2
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.8	Fire Effects & Regime	3	Fire Condition Class	3
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	2
					Terrestrial Invasive Species	3	Extent & Rate of Spread	3
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2014 Condition Class	Indicator	2014 Condition Class	Core Indicator	2014 Condition Class	Attributes	2014 Rating
110200030103	West Monument Creek	2.4	Aquatic Physical	2.2	Water Quality	2	Impaired Waters	1
							Water Quality Problems	3
					Water Quantity	2	Flow Characteristics	1
					Aquatic Habitat	2.7	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	3
			Aquatic Biological	2.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	3	Vegetation Condition	3
			Terrestrial Physical	2.3	Road & Trail Network	2.3	Open Road Density	2
							Road Maintenance	3
							Proximity to Water	3
							Mass Wasting	1
					Soil	2.3	Soil Productivity	3
							Soil Erosion	3
							Soil Contamination	1
			Terrestrial Biological	2.2	Fire Effects & Regime	3	Fire Condition Class	N/A
							Wildfire Effects	3
					Forest Cover	3	Loss of Forest Cover	3
					Rangeland	2	Vegetation Condition	2
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020602	Headwaters West Plum Creek	1.5	Aquatic Physical	1.5	Water Quality	1.5	Impaired Waters	1
							Water Quality Problems	2
					Water Quantity	1	Flow Characteristics	1
					Aquatic Habitat	2	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	1
			Aquatic Biological	1.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	1	Vegetation Condition	1
			Terrestrial Physical	1.4	Road & Trail Network	1.5	Open Road Density	1
							Road Maintenance	1
							Proximity to Water	3
							Mass Wasting	1
					Soil	1.3	Soil Productivity	1
							Soil Erosion	2
							Soil Contamination	1
			Terrestrial Biological	1.4	Fire Effects & Regime	2	Fire Condition Class	2
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	1
					Terrestrial Invasive Species	1	Extent & Rate of Spread	1
					Forest Health	2	Insects & Disease	1
							Ozone	3

HUC	Watershed	2010 Condition Class	Indicator	2010 Condition Class	Core Indicator	2010 Condition Class	Attributes	2010 Rating
101900020103	Long Gulch-Trout Creek	2.3	Aquatic Physical	2.6	Water Quality	3	Impaired Waters	3
							Water Quality Problems	3
					Water Quantity	2	Flow Characteristics	2
					Aquatic Habitat	2.7	Habitat Fragmentation	3
							Large Woody Debris	2
							Channel Shape and Function	3
			Aquatic Biological	2.7	Aquatic Biota	2.3	Life Form Presence	2
							Native Species	2
							Exotic and/or Invasive Species	3
					Riparian Vegetation	3	Vegetation Condition	3
			Terrestrial Physical	2	Road & Trail Network	2	Open Road Density	2
							Road Maintenance	3
							Proximity to Water	2
							Mass Wasting	1
					Soil	2	Soil Productivity	2
							Soil Erosion	3
							Soil Contamination	1
			Terrestrial Biological	1.4	Fire Effects & Regime	2	Fire Condition Class	2
							Wildfire Effects	N/A
					Forest Cover	1	Loss of Forest Cover	1
					Rangeland	1	Vegetation Condition	1
					Terrestrial Invasive Species	2	Extent & Rate of Spread	2
					Forest Health	1	Insects & Disease	1
							Ozone	1